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SCOTLAND.

A PRELIMINARY REVIEW OF THE OCCURRENCE
OF ASELLUS (CRUSTACEA: ISOPODA) IN THE BRITISH ISLES

by

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and

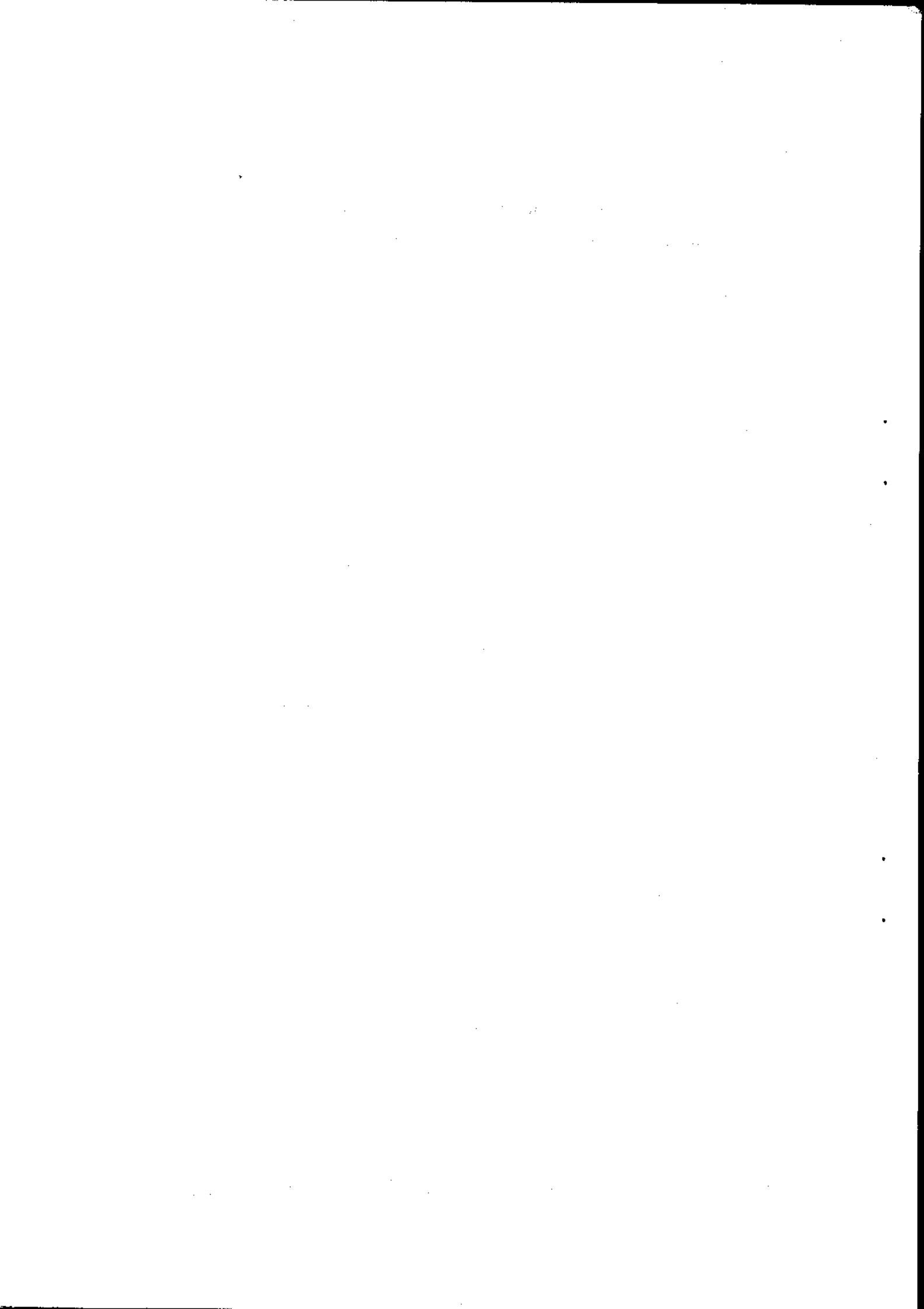
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1981

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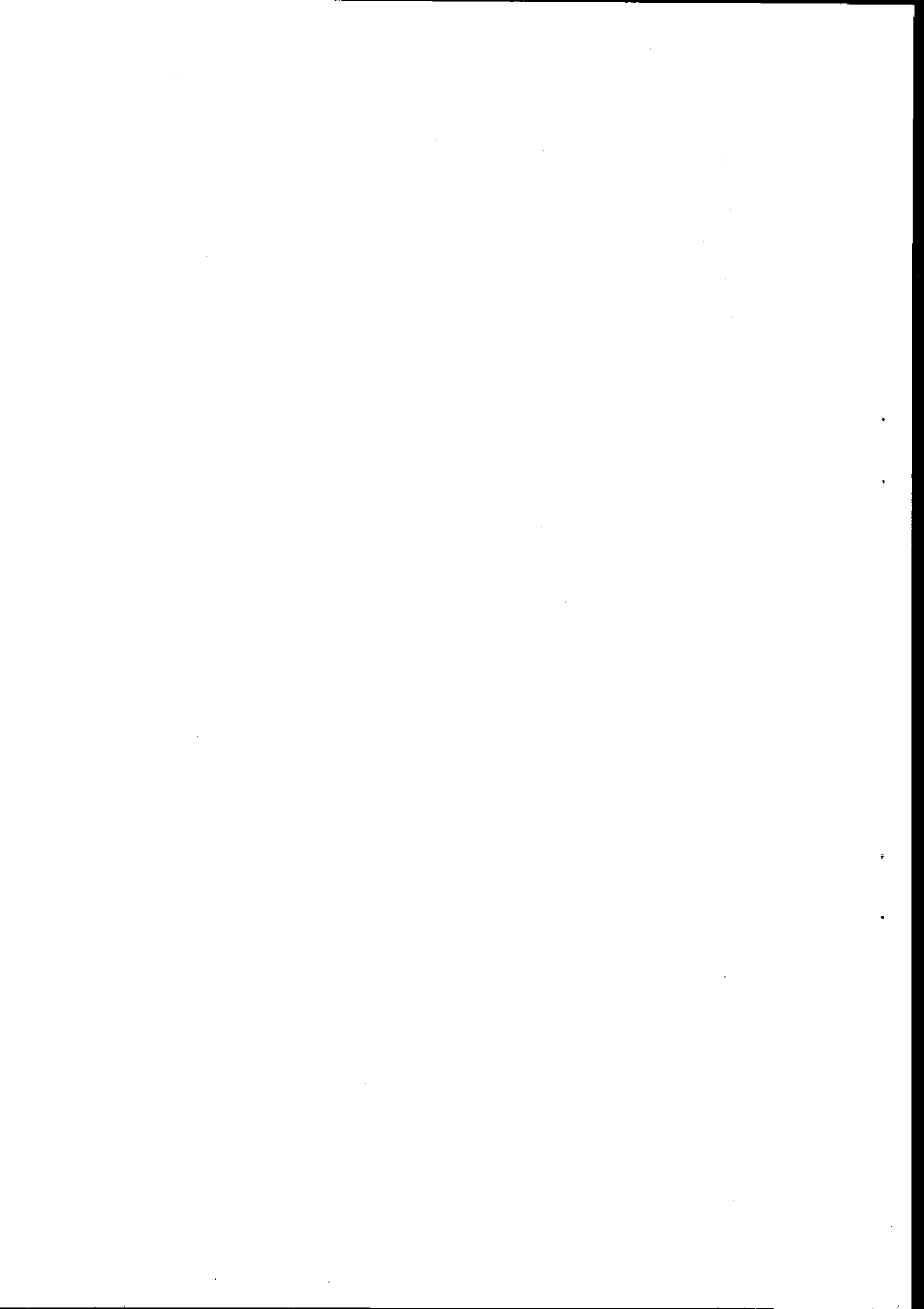
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MAPS

Asellus spp. - Records received
Asellus cavaticus
Asellus aquaticus
Asellus meridianus



INTRODUCTION

The distribution of the two native surface-dwelling species of *Asellus* in the British Isles has been studied by Moon (1957a, b) and Williams (1962a, b, 1963, 1979). The early conclusions of these authors were that interspecific competition existed between *Asellus aquaticus* and *A. meridianus*. Later work by both authors has tended to provide evidence of a less conclusive nature, although Williams (1979) still supported the proposition that replacement of *A. meridianus* by *A. aquaticus* was taking place.

The evidence, initially of Moon and later of Williams, was drawn from detailed surveys of limited geographical areas. This was supplemented, in the case of Williams (1962a), by a more general survey organised on a county basis. It is hoped that a more detailed general survey of the occurrence of *Asellus* in the British Isles would provide data to enable the proposition of Williams (1979) to be examined. Such a survey was begun in 1970 as part of the Non-marine Isopoda Survey Scheme organised by the British Isopoda Study Group. Although the survey of terrestrial species has enjoyed considerable support (Harding, 1976) the survey of *Asellus* has been less well supported. This preliminary review is a statement of the progress of the survey and, it is hoped, an inducement to further recording, particularly in areas where *Asellus* species may be at the limits of their range.

THE SPECIES

Four species of *Asellus* have been recorded in the British Isles. *Asellus aquaticus* (L.) was recorded in Britain in the first half of the 19th century (White, 1847) and was originally thought to be the only species of the genus present in the British Isles (e.g. Bate & Westwood, 1868). However, Racovitza (1919) described several new species of *Asellus* from Continental Europe, one of which, *Asellus meridianus* Racovitza, was recorded by him from Dulwich, Kent and from Devon. Soon after that, *A. meridianus* was recorded from Derbyshire (Tattersall, 1920), Tunbridge Wells, Kent (Chilton, 1920), and Wicken Fen, Cambridgeshire

(Omer Cooper, 1925). A third species, *Asellus cavaticus* Schiödte, was added to the British list by Tattersall (1930) based on material from a well in Hampshire. In 1962, the North American species, *Asellus communis* Say was discovered in an ornamental lake in Northumberland (Sutcliffe, 1972, Williams, 1972).

Although the list for the British Isles currently includes only four species, an additional four species were listed by the late W.E. Collinge. Of these, *Asellus patoni* Collinge, 1945, *Asellus quicki* Collinge, 1946 and *Asellus hazeltoni* Collinge, 1946 were considered by Moon (1953) to be synonymous with *A. aquaticus* and *A. meridianus*. The suggestion made by Moon (*op. cit.*) that the fourth species, *Asellus crypticus* Collinge, 1945, was synonymous with *A. meridianus* was confirmed by Harding & Moon (1976). A putative asellid, *Stenasellus hazeltoni* Collinge, 1946, was shown by Edney (1953) to be synonymous with the terrestrial species *Androniscus dentiger* Verhoeff.

IDENTIFICATION

A description and figures of *A. aquaticus* were given by Bate & Westwood (1868). This species and *A. meridianus* were described and figured by Racovitza (1919). Tattersall (1930) described and figured *A. cavaticus*, and *A. communis* was described and figured by Williams (1970, 1972).

The use of the coloration of the head as a means of identification in *A. aquaticus* and *A. meridianus* was noted by Scourfield (1940). Despite the fact that this coloration is acknowledged to be variable and therefore unreliable as a taxonomic character, several "popular" identification guides have used this character as the sole means of separating the three native species (e.g. Woods, 1974).

An illustrated key to the British (and Irish) species was given by Hynes, Macan & Williams (1960) and a revised version by Gledhill, Sutcliffe & Williams (1976).

RECORDING

SOURCES OF RECORDS

Detailed surveys (H.P.M.) in midland England, particularly Leicestershire, the Lake District and at sites elsewhere in Britain provided a substantial nucleus of records. This has been supplemented by records abstracted from mainly published sources (H.P.M.) and by records from other surveys, in particular those by D.G. Holland and W.D. Williams. The original data used by Professor Williams in his accounts of the vice-county distribution of *Asellus* (Hynes *et al.*, 1960, Williams, 1962) were generously contributed by him. The Isopod Survey of the British Isopoda Study Group has supplied a wide scatter of records. Records of *A. cavaticus* have been derived mainly from the publications of the Cave Research Group and its successor, the British Cave Research Association.

LIMITS OF COVERAGE

It is clear from the map of records received (Map 1) that the coverage so far obtained, even when viewed in the summarised form of a 10 km. square distribution map, is very irregular. The distribution appears to be that of the collectors rather than of *Asellus* spp. This appearance is misleading because there is no display of "negative records", i.e. those from sites where *Asellus* have been sought, but not found.

RECORDING SYSTEM

Many of the records used in the preparation of the distribution maps have been from contributions to the Isopod Survey using a recording card (Figure 1) designed by the British Isopoda Study Group in collaboration with the Myriapod Study Group and the Biological Records Centre. The recording card was not designed primarily for *Asellus*, but it does provide the facility to record more information about a recording site than the usual strictly geographical and temporal information recorded with most other distribution recording schemes. Data for *Asellus*, submitted on these recording cards, have yet to be fully analysed because more data are required before meaningful interpretations may be made.

FUTURE RECORDING

The gaps in coverage are obvious on the maps that follow. Future recording should be directed towards improving coverage generally. However, some areas would certainly repay survey and would provide information of use in establishing the areas where *A. aquaticus* *A. meridianus* are less commonly found. Particular emphasis should be given to surveying the west midlands of England and the Welsh border counties, the lowland fringes of Exmoor, Dartmoor and Bodmin Moor, the lowland areas around Carlisle and along the eastern coast of Scotland. In southern England the Sussex/Hampshire borders, Essex and Suffolk are particularly badly recorded. Ireland is poorly recorded generally, but the southern and south-western counties are particularly bad.

Recording will continue to be organised by the British Isopoda Study Group. Requests for information, recording cards and instructions for their use should be sent to P.T.H.; specimens for identification or checking also should be sent to P.T.H. (see below).

SURVEY METHODS

Advice for potential recorders

EQUIPMENT

Net - This is an essential item. The simplest and often most effective net is a 6" (15 cm.) or 8" (20 cm.) diameter wire kitchen strainer (sieve) attached to a broom handle by string, wire or a metal clip such as a "Jubilee" clip. Proper metal-framed water nets are expensive and have at times been difficult to obtain. It is believed that good quality nets are available from the five suppliers listed in the Appendix. Some of these suppliers also sell net-bags which will fit some types of anglers' landing-net frames. It is possible to obtain lightweight net frames and handles at any good angling shop. The telescopic handles used by some anglers are particularly useful when travelling, as they fit into a ruck-sack or suitcase.

Sorting Tray - A white enamel or plastic dish at least 6" (15 cm.) square with sides a minimum of 1½" (4 cms.) high is essential for the effective examination of the contents of a water net. Suitable dishes are usually available from hardware shops and photographic suppliers, also from some of the companies listed in the Appendix.

Other - Forceps and wide bore bulb pipettes are almost essential for picking up specimens. Specimens should be kept in fluid-tight tubes or bottles using 70% industrial methylated spirits as a preservative. Alternative temporary preservatives are 5% Formalin solution, mineralised methylated spirit or iso-propyl alcohol. The above items should be obtainable from a good chemist or from some of the companies listed.

HOW TO COLLECT

In mud, rotten leaves and other debris - The net should be agitated in the top ½" to 1" (1½ to 3 cms.) of substrate over a wide area and then swept through the resultant cloud of debris. Muddy samples may be washed clean in the net by agitating the net in the water.

In dense aquatic vegetation and reed beds - Work the net vigorously through the substrate and vegetation to dislodge specimens from the vegetation.

In stony/gravelly substrate - Disturb the substrate by stirring with the feet and then run the net through the disturbed debris, allow any current to wash debris down into the net. Large stones etc. should be rubbed over and washed in the net to disturb specimens which may cling to the surface. In the absence of a net, *Asellus* may sometimes be found by searching the undersides of stones on the shores of lakes, reservoirs and rivers or in shallow streams and rivers.

It is usually best to sample a locality at two or three stations to ensure that adequate coverage is obtained. Always wash out the net before moving on to the next locality to avoid contamination of samples.

SORTING

This is best done using a large white dish, whether it is done in the field, at home or in the laboratory, because it is easier to see the animals among the matrix against a white background. *Asellus* survive well in damp vegetation or debris if kept in a polythene bag or water-tight bottle, and it is often more effective, easier and more comfortable to take samples back rather than attempt to sort them in the field.

IDENTIFICATION

An identification service is operated as part of the recording scheme. Specimens for identification or checking should be sent to Mr P.T. Harding at Monks Wood Experimental Station. Specimens should be labelled with the following details: locality (preferably with a grid reference), date of collection, name of collector and habitat. It is preferred that each collection for identification is accompanied by a completed record card, but if this is not possible, specimens should be accompanied by labels giving all the available information.

RECORDING CARD (Figure 1)

The card was designed mainly for use with terrestrial animals, but it should be possible to place one tick in each of Sections A, B, C, and G. Section C (other than the Aquatic portion) refers to the general area in which the pond, stream, ditch, etc. occurs. Thus if *Asellus* are found in a pond in a field of ungrazed grass, tick "Grassland: ungrazed" in Section C and "Pond" in Section D. Make use of the space for notes to describe the habitat where there is uncertainty about how to treat it within the habitat classification.

SPECIES ACCOUNTS

ASELLUS CAVATICUS Schiödte

Asellus cavaticus is eyeless and devoid of pigment. It has been recorded mainly from underground streams, pools and wet surfaces in limestone caves and mines, from where underground waters issue on the

surface such as the water sources of water-cress beds and springs, and from bore-holes and wells.

Most records have been from caves and mines where cave biologists have taken a special interest in the occurrence of one of the few truly troglobitic invertebrates in the British Isles. Many caves and mines in midland England northwards have been surveyed, but *A. cavaticus* has not been recorded. The distribution of the species has been correlated with the southward limits of the ice-sheets during the Pleistocene glaciations. However, this view seems to overlook the fact that arctic conditions existed over the remainder of Britain during the later glacial maxima (see Coope, 1977). It seems improbable that any subterranean fauna associated with temperate zones could have survived in the permafrost that would have affected Britain south of the ice sheets.

Although most records have been from caves and mines, more collections from wells, springs and riverine gravels might reveal a wider distribution of this species than is presently apparent. The abandonment of wells in favour of piped water supplies has meant that a useful contact with underground water systems has been lost. Surviving deep wells should be examined wherever possible.

ASELLUS COMMUNIS Say

A map of the occurrence of this species has not been included, as it has been recorded from only one locality - Bolam Lake, Northumberland (National Grid reference 45(NZ)/080818). Detailed accounts of the occurrence of *A. communis* at Bolam Lake were given by Sutcliffe (1972) and Williams (1972). First recorded by Sutcliffe in June 1962, it has been collected at the lake on several occasions subsequently. Bolam Lake is shallow with a bottom of mud, overlain in autumn and winter by decaying aquatic vegetation and fallen leaves. Specimens were collected usually from the fallen leaves using a small hand net.

The lake was constructed in 1818-19 and contains a rich and diverse fauna including native species of molluscs, leeches and insects, but it also contains two other introduced North American species; Canadian pondweed (*Elodea canadensis* Michx.) and the amphipod *Crangonyx*.

pseudogracilis Bousfield, both of which are now quite widespread in Britain. However, Sutcliffe (1972) suggested that the introduction of *A. communis* was a single, isolated event unconnected with the introduction and subsequent spread of these other North American species.

Asellus aquaticus and *A. meridianus* have not been recorded from Lake Bolam. Williams (1972) suggested that their absence was possibly due to replacement by *A. communis*. It is, however, common to find apparently suitable sites where one or both species is absent, although common in neighbouring sites. Any suggestion that replacement by *A. communis* has occurred, must only be speculative.

ASELLUS AQUATICUS (L.) and A. MERIDIANUS Racovitza

Both species are commonly found in still or slow flowing waters, for example, field ponds, canals and lowland lakes, streams and rivers. They occur in mud, rotting leaves and other dead vegetation, reed beds and dense aquatic vegetation. They are recorded less commonly in stony/gravelly streams and small rivers and on the wave-washed shores of lakes and reservoirs.

From the evidence available at present it seems probably that *A. aquaticus* and *A. meridianus* have restricted distributions in dry areas with few streams and ponds, such as Salisbury Plain and the Wiltshire chalk area, the Oolite ridge running from the Cotswolds north to the Humber, the Breckland of Norfolk and Suffolk, the Lincolnshire and Yorkshire Wolds and the North Yorkshire Moors. However, any such restrictions would be unlikely to be apparent at the scale of mapping used here, except that the infrequent occurrence of suitable habitat tends to lead to infrequent recording.

In contrast, the surveys in Leicestershire and adjoining counties show the abundance of sites where *A. aquaticus* and *A. meridianus* occur, but this too is not possible at the present scale of mapping. Were more data available, it would be practicable to devise a style of mapping which would demonstrate the number of occurrences or sites recorded in each mapping unit (for example, see Pollard, 1974).

It is always difficult to establish the true absence of a species at a site, but our experience suggests that *A. aquaticus* and *A. meridianus* are usually absent at sites above about 700 ft. (210 metres) in altitude, in upland areas of moorland or peat soils, and in areas of acid heathland. Turbulent streams are also not favoured by these species. *Asellus* have not been recorded on Shetland, even in apparently suitable habitats (Britton, 1974).

DIFFERENCES BETWEEN THE DISTRIBUTIONS OF *A. AQUATICUS* AND *A. MERIDIANUS*

An apparent decline in the occurrence of *A. meridianus* corresponding with an increase in the occurrence of *A. aquaticus* has resulted, it has been suggested, from interspecific competition (Moon, 1957a, b; Williams, 1962a, b, 1963, 1979). Williams (1962b) regarded *A. meridianus* as the first of the two species to re-colonise the British Isles after the end of the last glaciation. *A. aquaticus* was considered to have followed, to have competed with and, in places, to have replaced *A. meridianus*. The dominance of *A. meridianus* at sites on exposed western coasts and on islands was taken to indicate the retreat of this species in the face of competition.

A more probable explanation of the dominance of *A. meridianus* on exposed western coastal sites is that the high sodium content of these waters (sodium being derived from gale-driven sea spray) favours this species. *A. aquaticus* is adapted to a lower sodium content in water (Sutcliffe, 1974) and the conditions that may favour *A. meridianus* on the western seaboard are to some extent comparable to those that have been demonstrated to favour the amphipod *Gammarus duebeni* Liljeberg in western Britain (Sutcliffe, 1967).

The suggestion that interspecific competition was occurring was supported mainly by observations in the field and some simple experiments. Many examples of the co-existence of the two species in the field are known from published sources and from records submitted to the present survey. Controlled laboratory experiments showed that cultures of the two species could co-exist (Dupey, 1967).

A. aquaticus and *A. meridianus* are very similar species, occupying the same habitat and eating the same food, vegetation and general organic debris, which is always in excess. Neither field surveys nor controlled laboratory experiments have given any real indication of how the two species might come into direct competition. However, slight differences between the two species are apparent, and these might enable one species to exploit a particular aspect of the habitat more successfully than the other. Tolerance of sodium levels has already been mentioned. The two species have slightly different temperature optima (Dupey, 1967; Marcus, 1979), the life histories are modified in relation to latitude (Adcock, 1979) and predation may also be a factor (Dupey, 1967; Byford, 1974). Differences in food consumption, digestion, food conversion and growth efficiency have been observed in laboratory cultures (Dupey, 1967). Comparisons are not really possible, because most of the experimental work has been concentrated on *A. aquaticus*, and there is no modern comparative account of the internal anatomy of the two species.

There may be other differences which affect the ability to colonise, such as the capacity to withstand passive transport from site to site. Furthermore, the physical and chemical environments of many freshwater bodies have been subject to various changes for many decades; changes which could have influenced the occurrence of the species. For example, the amount of sodium chloride in Esthwaite Water, Grasmere, Ullswater and neighbouring lakes has increased in recent years (Sutcliffe, 1974).

The available evidence suggests that the occurrence of *A. aquaticus* and *A. meridianus* may be changing at some localities, but the numbers of specimens of either species recorded at a site on a given date could be subject to a variety of interpretations. The evidence of Williams (1979, Table 4) suggested that extreme caution should be exercised in interpreting either a single sampling record or a series of records from a site made over a period of time. Colonisation of previously uncolonised sites seems to have occurred (Moon 1964, 1968; Williams, 1979) but great care must be exercised in the interpretation of apparent absences (Moon 1964). The means by which the larger flightless freshwater invertebrates colonise new sites is a neglected topic which

deserves further research. It is clear that any dynamic changes that may be occurring among populations of *A. aquaticus* and *A. meridianus* in the British Isles are gradual and are in no manner as rapid as, for example, the colonisation of waters in Britain by the North American amphipod *Crangonyx pseudogracilis* since its first recorded occurrence in 1937 (Crawford, 1937).

The point was made by Moon (1968) that any changes with time in the composition and distribution of freshwater faunas may occupy periods of time greater than the life span of individual ecologists, hence the need for careful collection and storage of records over long periods.

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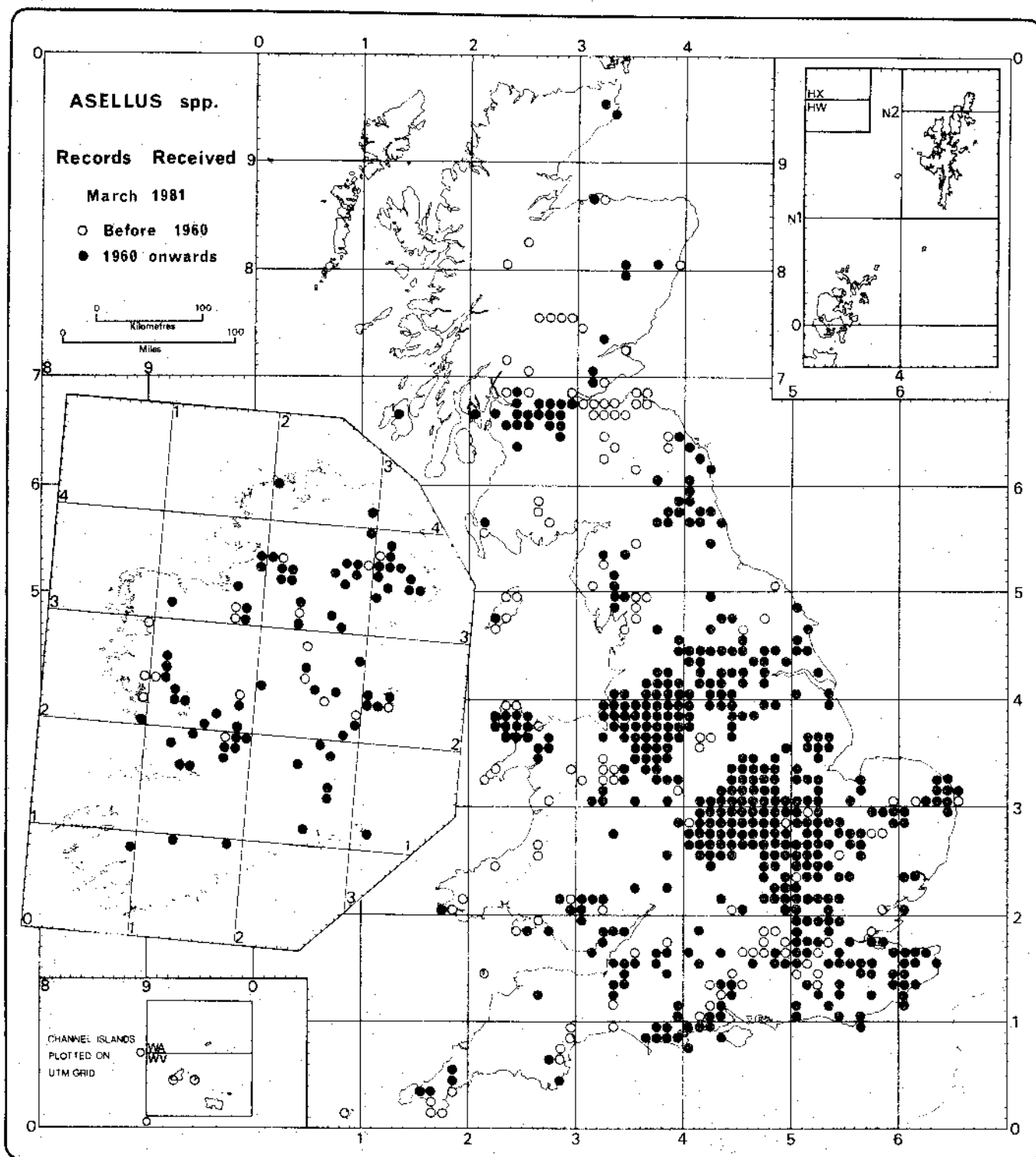
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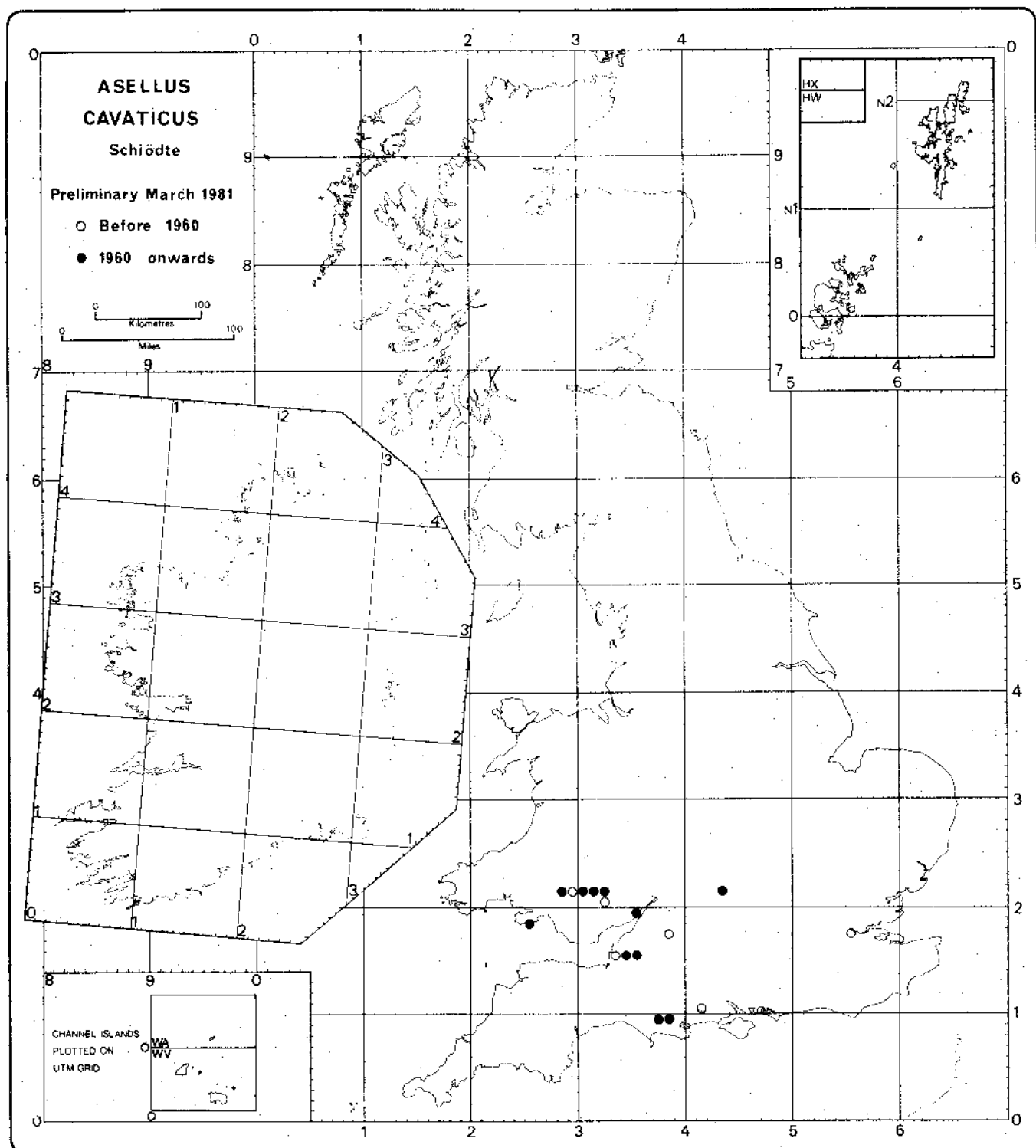
APPENDIX

A list of suppliers of water-nets and other equipment (reproduced with permission from the Balfour-Browne Club Newsletter No. 13, July 1979).

1. ANTOX (U.K.) LTD., West Street, Swadlincote, Burton-on-Trent, Staffs. DE11 9DG. Tel.: 0283-215659.
2. Mr. S.M. DAVIS, 25 Quant Hills Road, Malvern, Worcs. Tel.: 06845-65520.
3. GRIFFIN & GEORGE LTD.
285, Ealing Road, Wembley, Middx. HA0 1HJ. Tel.: 01-997-3344.
Ledson Road, Wythenshawe, Manchester MN23 9NP.
Tel.: 061-998-5221.
Braeview Place, Nerston, East Kilbride, Glasgow G74 4XJ.
Tel.: 03552-22281.
Shaw Scientific Services Ltd., St James' Place, Tyrconnell Road, Inchicore, Dublin 8. Tel.: Dublin 756676.
4. PHILIP HARRIS LTD.
Lynn Lane, Shenstone, Staffs. WS14 OEE. Tel.: 0543-480077.
30, Carron Place, Kelvin Industrial Estate, East Kilbride, Glasgow G75 0TL. Tel.: 03552-34983.
5. WATKINS & DONCASTER LTD.
Four throws, Hawkhurst, Kent. Tel.: 05805-3133.

M A P S





ASELLUS AQUATICUS (L.)

Preliminary March 1981

- Before 1960
- 1960 onwards

0 100
Kilometres
0 100
Miles

